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GEOGRAPHICAL VARIATIONS IN SHORTIA GALACIFOLIA

P. A. Davies

Asa Gray, while at the Jardin des Plantes, Paris, in 1839, found in Andre Michaux's herbarium an unnamed specimen bearing the label, "Hautes montagnes de Carolinie, *An pyrola spec.*? *An genus novum*?" Dr. Gray named the plant *Shortia galacifolia* in honor of his friend and botanical colleague Charles W. Short of Kentucky who sent him many well-prepared trans-Alleghanian specimens.[1] There is evidence to indicate that Michaux found this specimen in 1787 or 1788 at the sources of the Keowee River in South Carolina. On returning to New York, Gray and other plant collectors, mistaking Michaux's label to mean the high mountains northeast of Ashville, sought in vain for *Shortia* in this area. In the spring of 1877, George M. Hyams rediscovered *Shortia* on the banks of the Catawba River in McDowell County, North Carolina, about five miles north of Marion.[2] Nine years later (1886), Charles S. Sargent found it in Oconee County, South Carolina, at the confluence of the Toxaway and Horse Pasture (Green) Rivers.[3] The same year, Frank E. Boynton discovered large quantities of *Shortia* on Bear Camp Creek, a lower tributary of the Horse Pasture River,[4] and three years later (1889) found acres of it in the area about the junction of the Whitewater River and Devil's Fork Creek, and in the lower Jocassee Valley, all in Oconee County.[5] In the spring of 1890, T.

[1] Gray, Asa, Amer. Jour. Sci. & Arts, **42**: 1–49, 1842.
[2] Letter, J. W. Congden to Asa Gray, Oct. 18, 1878 (Gray Herb.).
[3] Sargent, C. S., Amer. Jour. Sci. & Arts, Ser. III, **32**: 466–473, 1886.
[4] Letter, F. E. Boynton to C. S. Sargent, Nov. 7, 1886 (Gray Herb.).
[5] Boynton, F. E., Garden & Forest, **2**: 214–215, 1889.

G. Harbison discovered *Shortia* in great abundance on the Horse Pasture River, between its junction with the Toxaway River and Bear [Camp] Creek.[6]

Recently, Charles F. Jenkins sought for specimens of *Shortia galacifolia* in thirty-one of the leading herbaria in the United States and found ninety-eight sheets. From information on the specimen-sheets he gives the following distributions: "Of these forty-four were collected along the banks of the Whitewater River in Oconee County, S. C. Fourteen more are listed as coming from the Jocassee Valley, also in Oconee County. Thirteen were found in McDowell County, N. C. more definite locations not being given. Eight were found in the Toxaway Gorge in Transylvania County, N. C., three along Bear Camp Creek and two along the Horse Pasture River, both locations in Transylvania County. One each from "the mountains of N. W. Carolina," "4 miles N. W. Salem, S. C." and "Macon Co., N. C." The remainder are specimens with labels giving no definite locality or coming from cultivated plants."[7] Through the kindness of William C. Coker, University of North Carolina, a map was received showing all the locations of *Shortia galacifolia* known to him.[8] On his map were shown stations of *Shortia* not indicated in Jenkin's report. Numerous stations were located on the sources of the Little River in Oconee County; several stations on the right bank of the Keowee, above the entrance of Eastatoe Creek, also in Oconee County; and two stations on the left bank of the Keowee, below the entrance of Eastatoe Creek in Pickens County. The latter is a new county record. H. J. Oosting, of Duke University, collected *Shortia* in the Toxaway Gorge in Transylvania County, North Carolina.[9] The Rev. A. Rufus Morgan, Franklin, North Carolina, found it on the Toxaway River above the North Carolina border and on the Whitewater River just above its junction with the Thompson River.[10]

Wilbur H. Duncan, Haskell Venard, and G. W. McDowell discovered in March, 1949, a colony of *Shortia* (eight by four

[6] Clute, W. N., Amer. Bot., 32: 65–68, 1926.

[7] Jenkins, C. F., Arnoldia, 2: 13–28, 1942.

[8] Map, W. C. Coker, Botany Dept. Uni. North Carolina, copy sent to P. A. Davies, May, 18, 1948.

[9] Specimen in Gray Herb. collected July 15, 1936.

[10] Map, A. Rufus Morgan to P. A. Davies, Aug. 8, 1951.

feet) near Reed Creek in Rabun County, Georgia, and in August of the same year the senior author found a small colony near the original one.[11] The writer examined a specimen sent to the Gray Herbarium by Duncan, Venard, and McDowell from Rabun County, Georgia and found it to have the same characteristics as plants collected from the sources of the Keowee River.

The range of *Shortia* on the tributaries of the Catawba River in McDowell County, North Carolina, is rather small. A few colonies are present on Lackey Branch, a small tributary of Tom's Creek. Numerous colonies can be found on the Fish Hatchery Creek (John's Creek) above the hatchery. On the upper part of the creek (no name) and its branches which run beside the road leading to the Joe McNeely farm, *Shortia* is rather abundant. F. M. Crayton has found *Shortia* on the Linville River west of Table Rock in Burke County, North Carolina.[12]

Distribution data show that *Shortia* is confined to two general areas. One comprising Oconee and Pickens Counties, South Carolina; Transylvania and Macon Counties, North Carolina; and Rabun County, Georgia. The other area, across about 60 miles of mountainous terrain is in McDowell and Burke Counties, North Carolina.

On March 22, 1951, the author had the opportunity of gathering *Shortia galacifolia* in flower on the Whitewater and Horse Pasture Rivers, tributaries of the Keowee River in Oconee County, South Carolina. The next day, March 23, he collected plants in flower on Fish Hatchery Creek (John's Creek) and on the creek running beside the road leading to the Joe McNeely farm, both tributaries of the Catawba River in McDowell County, North Carolina.

In the latter part of May, 1951, the writer collected specimens of *Shortia* in fruit on the Horse Pasture River; Bear Camp Creek; Toxaway River, both above and below its junction with the Horse Pasture River; at the confluence of the Toxaway and Whitewater Rivers; along the Whitewater below its junction with the Thompson River and about one half mile along the lower part of the Thompson River, all in Oconee County, South Carolina. Also two collections were made on the upper part of

[11] Duncan, W. H., Haskell Venard and G. W. McDowell, Rhodora, 52: 229–232, 1950.

[12] Letter, F. M. Crayton to P. A. Davies, June 22, 1951.

Bear Camp Creek in Transylvania County, North Carolina. On June 1, 1951, specimens in fruit were gathered on Lackey Creek, a small tributary of Tom's Creek; on John's Creek above the Fish Hatchery and on the creek which runs beside the road leading to Joe McNeely's farm, all in McDowell County, North Carolina.

Distinct floral variations are exhibited by *Shortia* from these two areas.

Keowee River	Catawba River
Petals 16.20–19.20 mm. long	Petals 14.0–16.5 mm. long
Apical petallary notches 7–13; 0.10–2.58 mm. deep	Apical petallary notches 14–21; 0.10–1.42 mm. deep
Veins of petals few	Veins of petals numerous
Staminodial hairs 0.24–0.25 mm. long	Staminodial hairs 0.10–0.11 mm. long
Styles 14.6–16.0 mm. long, slender	Styles 9.6–10.27 mm. long, stout

Michaux's type specimen lacked petals, stamens and staminodia. Drawings of this specimen, including a separate complete pistil, made by M. Joseph Decaisne in 1839 is in the Gray Herbarium. In order to determine the source of Michaux's specimen, an index was developed between the average length of mature ovaries and that of the styles. For specimens from the sources of the Keowee River the index was 1:2.37 and from the Catawba River was 1:1.28. Using the index, it shows that Michaux's specimen came from the sources of the Keowee.

Considering plants of *Shortia galacifolia* Torr. & Gray from the sources of the Keowee River as typical of the species as originally described, and plants from the sources of the Catawba River as variants from this type, the author is establishing a new variety for the plants from the sources of the Catawba River.

Shortia galacifolia Torr. & Gray var. **brevistyla,** var. nov., petalis 14.0–16.5 mm. longis, apice 14–21-serratis, sinubus 0.10–1.42 mm. altis; venis petalorum numerosis; staminodiis hirsutis pilis 0.10–0.11 mm. longis; stylo 9.6–10.27 mm. longo, crasso.

The type of *Shortia galacifolia* Torr. & Gray var. *brevistyla* Davies has been deposited in the Gray Herbarium.

Dept. of Botany, University of Louisville, Louisville, Kentucky.

FURTHER STUDIES OF THE OKLAHOMA FLORA

U. T. Waterfall

Further studies of the Oklahoma flora have resulted in increased data concerning the distribution of species within the state, including several not found previously recorded in monographs, floras or check-lists as occurring within Oklahoma. In the following account the latter taxa are prefixed with an asterisk. Unless otherwise indicated the cited material will be found in the herbarium of Oklahoma A. & M. College.

*Sagittaria papillosa Buchenau. So referred is *Wehling 55*, 6 miles east of Harris, McCurtain County, June 15, 1946. This number has the obovate achenes, glabrous filaments and papillose bracts as described for *S. papillosa* by J. G. Smith (Mo. Bot. Gard. Rept. 6: 55. 1894) rather than the falcate achenes and glabrous filaments of *S. ambigua*, or the falcate achenes and arachnoid filaments of *S. lancifolia*. The distribution of *S. papillosa* was given by J. G. Smith (l. c.) as "shallow ponds, Texas and Louisiana."

*Digitaria violascens Link. The collections referred to this have short, narrow spikelets (less than 2 mm. long and about 0.7 mm. wide), dark lemmas, winged rachises and glabrous sheaths. They are: *Waterfall 10458*, wooded flats with *Sabal*, 3 miles south of Tom, McCurtain County, October 13, 1951; *Waterfall 10513*, along Little River, 0.3 miles south of Honobia, Pushmataha County, October 14, 1951. In Hitchcock's Manual (p. 578, 1950) Arkansas and Texas are given as constituting the western limit of this species' range in the United States.

*Panicum gymnocarpon Ell. This species is characterized by its stipitate smooth fruit about one-third as long as the second glume, which is about 6 mm. in length, and slightly longer than the sterile lemma, the latter being a little longer than the first glume. It has previously been known from as far west as Arkansas and eastern Texas (Hitchcock's Manual, p. 706, 1950). We have it from the extreme southeastern part of Oklahoma as *Waterfall 10412*, edge of Taxodium swamp 3 miles south and 1 east of Eagletown, McCurtain County, October 13, 1951.

*Paspalum pubiflorum Rupr., var. pubiflorum. Our material has all hitherto been referred to var. *glabrum* Vasey which has glabrous spikelets. We have one sheet of the typical variety with pubescent spikelets. It is: *McLean*, along Red River, 5 (15?) miles south of Durant, Bryan County, June 20, 1936.

*Sporobolus asper (Michx.) Kunth, var. pilosus (Vasey) Hitchc. In the eighth edition of Gray's Manual (154. 1950) Fernald states that the range of this variety is "E. Kans. to Texas." Chase (Hitchcock's Manual p. 417. 1950) says "Kansas, Texas . . . and Montana." We have several sheets of *S. asper* with pilose sheaths and blades.

*Fimbristylis autumnalis (L.) R. & S., forma brachyactis (Fern.) S. F. Blake. The form with suppressed inflorescence rays, or with the inflorescence reduced to one spikelet, was collected as *Waterfall 10219*, in mud at edge of pond, 3 miles east of Braggs, Muskogee County, July 17, 1951.

*Scleria pauciflora Muhl., var. caroliniana (Willd.) Wood. The pilose variety was collected as *Waterfall, 10069*, open woods, top of limestone hill, 8 miles northeast of Tahlequah, Cherokee County, June 25, 1951. The nearest area from which the variety was previously known according to Fernald (Gray's Manual, 292. 1950) is Missouri.

*Juncus filipendulus Buckley. The individual plants are somewhat similar in appearance to *J. repens*, although they are not repent. However the capsule is obovate and shorter than the narrow, linear-triangular fruit of *J. repens*. Engelmann, in his North American Species of Juncus,[1] cites material from Arkansas and Texas. This is done under the substitute name *J. leptocaulis*, a manuscript name of Torrey and Gray "from a label in Mr. Durand's herbarium." Engelmann says "I had to change the only published name of this species, *J. filipendulus*, because it is absolutely wrong, the fibrous rootlets bearing no tubers at all . . ." This procedure is, of course, contrary to the present Rules. Article 59 states "A name . . . must not be rejected . . . merely because it is badly chosen . . ." Buchenau[2] gives the range as "Tennessee, Arkansas, Alabama and Texas; wohl auch in den dazwischen liegenden Staaten."

We have the species as *Waterfall 6494*, limestone prairie, 4 miles northeast of Sulphur, Murray County, June 3, 1946.

*Trillium recurvatum Beck is easily recognized by the sessile flowers, petiolate leaves, ovate-lanceolate petals, and short reflexed sepals. We have it as *C. W. Prier*, sin num., in woods and thickets, Tahlequah, Cherokee County, April 7, 1925. Gates[3] says the species occurs from "Ohio to Minnesota, south to Mississippi and Arkansas. Fernald (Gray's Manual, 445. 1950) likewise gives Arkansas as the western limit of its range.

*Polygonum hydropiperoides Michx., var. bushianum Stanford, forma **rubrum,** Waterfall, f. nov.; folium rubris zonis. The type of the form having leaves with red markings, often V-shaped, is *Waterfall 10484*, swamp, Grassy Lake, 4 miles south and 4 east of Tom, McCurtain County, October 13, 1951. It is in the Herbarium of Oklahoma A. & M. College.

*Polygonum sagittatum L. Easily recognized by the capitate inflorescences, sagittate leaves and retrorse-prickly, 4-angled stems is this species collected as *Waterfall 10420*, ditch, 2.5 miles north of Tom, McCurtain County, October 13, 1951.

*Suckleya suckleyana (Torr.) Rydb. This monotypic genus is characterized by the bracts of the fruit being united to the summit, rather

[1] Trans. St. Louis Acad. Sci. 2: 454. 1868.

[2] Buchenau, Fr. Juncaceae, Das Pflanzenreich . . . 4 (36): 244. 1906.

[3] Gates, R. R. A Systematic Study of the North American Genus Trillium . . . Ann. Mo. Bot. Gard. 4: 49. 1917.

than free as in *Atriplex* which it somewhat resembles. These bracts are also obcompressed and dorsally carinate. These features are well shown in a plate published with the original description.[4] In the North American Flora (**21** (1): 74. 1916) Standley states that the species occurs "in valleys, Montana to Colorado." Hershey and Leyendecker (Leafl. W. Bot. **4**: 23. 1944) report it from Union and Quay Counties, New Mexico. We have it as *Waterfall 9696*, sand, bed of the Cimarron River, one-half mile north of Kenton, Cimarron County, October 6, 1950.

*Mirabilis gigantea (Standley) Shinners. This species, characterized by its glabrous, ovate or ovate-oblong leaves, upwardly-incurved pubescent stems and puberulent involucres, was described[5] from sands in Dallas County, Texas. Shinners[6] states that it is "a restricted endemic of north-central Texas from the Red River south to Waco, and from Dallas west to Weatherford." To this species is referred *Waterfall 9150*, sand north of Thackerville, Love County, July 14, 1949. This area is a few miles north of the Red River and north-central Texas.

*Saponaria vaccaria L., characterized by the large 5-winged fruiting calyx, was collected as *Rose*, sin num., 8 miles west of Ada, Pontotoc County, June 9, 1941.

*Nuphar ovatum (Mill. & Standl.) Standl. This species, characterized by the densely pubescent under-leaf surfaces and narrow leaf sinuses, is represented in our herbarium by *Stratton 569*, in water, 1 mile west of Broken Bow, McCurtain County, September 11, 1927. Described from Texas,[7] the distribution of the species was stated by Fernald (Gray's Manual: 639. 1950) to be "e. Tex., north to se. Kansas."

Euphorbia missurica Raf., var. **calcicola** (Shinners) Waterfall, comb. nov., *Chamaesyce missurica* (Raf.) Shinners, var. *calcicola* Shinners, Field and Laboratory **17**: 69. 1949. This transfer is made to keep the above taxon in the genus *Euphorbia*, rather than segregated into *Chamaesyce*. Shinners (l. c.) states that the range of var. *calcicola* includes Oklahoma, Kansas and Missouri as well as Texas.

Rhamnus caroliniana Walt., var. mollis Fern. This variety, with leaves pubescent beneath, was reported from the Arbuckle Mts. by E. J. Palmer.[8] In our herbarium we have a sheet, *John G. Brown*, sin num., rocky sandy soil, hillside 0.8 miles northeast of Tahlequah, Cherokee County, October 5, 1946.

*Sida rhombifolia L. This species somewhat resembles *S. spinosa*, but has cuneate-based, short-petiolate (2–4 mm.) leaves, and peduncles

[4] Gray, Asa. A Catalogue of Plants Collected East of the Rocky Mountains. Pacif. Railroad Reports. 12, pt. 2, no. 2: 47 + Pl. 4. 1860.

[5] Standley, Paul C. Allioniaceae of the United States. Cont. U. S. Natl. Herb. **12**: 348. 1909.

[6] Shinners, Lloyd H. North Texas Species of Mirabilis. Field and Lab. **19**: 177–178. 1951.

[7] Miller, Gerrit S. and Paul C. Standley. The North American Species of Nymphaea. Contr. U. S. Natl. Herb. **16**: 97–99. 1912.

[8] Palmer, Ernest J. Notes on Some Oklahoma Plants. Journ. Arn. Arb. **15**: 133. 1934.

several times longer (10–15 mm.) than the petioles of the leaves. In *S. spinosa* the cauline leaves are usually cordate, long-petiolate (10–20 mm.), and the peduncles are shorter (3–13 mm.) than the petioles. We have it as *Waterfall 9816*, edges of Taxodium swamp, 3 miles south of Eagletown, McCurtain County, October 21, 1950; and *Waterfall 10491*, swamp, Grassy Lake, 4 miles south and 4 east of Tom, McCurtain County, October 13, 1951. Small (Manual p. 850. 1933) states that the species occurs in the "Coastal plain, Florida to Texas and North Carolina."

*Ascyrum hypericoides L., var. oblongifolia (Spach) Fern. This Coastal Plain variety, having single stems branched above, oblong-lanceolate leaves and elongate flowering branches, was collected as *Waterfall 10452*, wooded flats with *Sabal*, 3 miles south of Tom, McCurtain County, October 13, 1951. Fernald (Rhodora **38**: 433. 1936) says it ranges from "Florida to Mississippi, north to eastern Maryland, western Tennessee and southeastern Missouri."

*Hypericum perforatum L. This introduced species was collected as *Waterfall 10160*, disturbed prairie, 2 miles east of Braggs, Muskogee County, July 10, 1951.

*Hypericum tubulosum Walt., var. walteri (Gmel.) Lott, is characterized by the 9 stamens in 3 bundles alternating with 3 glands, and by the oblong leaves. It was collected as *Waterfall 9797*, edges of Taxodium swamp, 3 miles south of Eagletown, McCurtain County, October 21, 1950, and *No. 10409*, Taxodium swamp, 3 miles north and 1 east of Eagletown, McCurtain County, October 13, 1951. In Gray's Manual, ed. 8, Fernald states that the range includes "Cypress and gum swamps, Florida to Texas, north to . . . south Indiana and southeast Missouri."

*Angelica venenosa (Greenway) Fern. This pubescent-fruited *Angelica* was collected as *Waterfall 10175*, richly wooded valley, 6 miles northeast of Scraper, in Adair County, July 11, 1951. Mathias and Constance (N. Am. Fl. **28B** (2): 199) give as the distribution of this species "Massachusetts to Florida, west to Minnesota and Mississippi."

Cymopterus macrorhizus Buckl. This species, recognizable by its scarious bractlets, fruit-wings nearly uniform rather than enlarged toward the base, and fruiting peduncles overtopping the leaves, is represented in our herbarium by *Waterfall 5536*, gypseous soil overlaying gypsum, low gyps hills, 1 mile west and ½ south of Weatherford, Custer County, May 13, 1944, and by *Stratton 6840*, gravelly clay pasture, 1.7 miles west and 2.4 north of Elk City, Beckham County, May 10, 1948 (det. by Lincoln Constance).

Mathias and Constance (l.s. 172.) state that the distribution of the species is in central Texas.

*Ipomoea heptaphylla (Rottb. & Willd.) Voight is easily recognized by its palmately 5–7 parted leaves and its filiform peduncles that sometimes spiral around adjacent objects. Small (Manual. 1087. 1933) says "near New Orleans, La., Nat. of Trop. regions." It was collected as *Waterfall 9831*, old field 4 miles south of Idabel, McCurtain County, October 21, 1950. Here it was quite abundant.

Gerardia pectinata (Nutt.) Benth. This species, characterized by its pinnatifid calyces and leaves, was cited from LeFlore County by Pennell[9] with the comment "species new to Oklahoma." We have it as *Waterfall 9847* in oak-pine woods on slopes near top of the Kiamichi Mountains, 3 miles east and 6 south of Albion, Pushmataha County, October 22, 1950.

*Physostegia angustifolia Fern. So referred are: *Waterfall 10007*, shallow soil on rock strata, 6 miles north of Braggs, Muskogee County, June 9, 1951; and *Waterfall 10088*, wet area in prairie 1.5 miles southeast of Braggs, Muskogee County, July 3, 1951. In our specimens the leaves are narrow and rigid as described by Fernald (Rhodora **45:** 462, 463. 1943). The fruiting inflorescences usually become rather remotely-flowered; however when first beginning to flower, they are often rather dense.

*Veronica polita Fries. This blue-flowered, long-pedicelled species is abundant on our campus, and various other places in this area in the early spring. We have it as *Waterfall 9900*, lawn, Oklahoma A. & M. Campus, Stillwater, Payne County, April 25, 1951.

*Hedyotis boscii DC. was collected as *Waterfall 10453*, wooded flats with *Sabal*, 3 miles south of Tom, McCurtain County, October 13, 1951. In Gray's Manual (1330. 1950) the range is given as Florida to Texas, north to southeast Virginia, Tennessee and southeast Missouri.

*Valerianella bushii Dyal. This species has flowers resembling those of *V. longiflora*, but has narrow, oblong pubescent fruits, with the sterile cells narrower than the fertile one, rather than orbicular fruit with large inflated widely divergent sterile cells as has *V. longiflora*. Dyal[10] cited specimens from Missouri and Arkansas. We have it as *Traylor 71*, sandy soil, northwest end of Spavinaw Lake, Mayes County, May 4, 1945; and *Wallis 500A*, open gravel bank of creek 0.7 miles south of Adair County line and 0.5 miles east of State highway 10, Cherokee County, May 27, 1951.

*Lobelia spicata Lam., var leptostachys (A. DC.) Mackenz. & Bush. In 1936 (Rhodora **33:** 306) and again in 1942 (N. Am. Fl. **32A** (1): 73) McVaugh gave "eastern Kansas and western Arkansas" as the western limit of the range of this variety. It is represented in our herbarium by *Waterfall 9574*, wooded valley, 3 miles south of Kansas, Adair County, July 7, 1950.

*Artemisia ludoviciana Nutt., var. latifolia (Bess.) T. & G. Referred to this variety are: *Waterfall 9702*, bank of Carrizozo Creek, 2 miles west of Kenton, Cimarron County, October 7, 1950 and *Waterfall 9725*, north slopes of Black Mesa, 3 miles north of Kenton, Cimarron County, October 7, 1950.

These collections have the short (3–4 cm. long), relatively broad leaf

[9] Pennell, Francis W., The Scrophulariaceae of Eastern Temperate North America. Acad. Nat. Sci. Phila. Monog. 1: 404. 1935.

[10] Dyal, Sarah C. Valerianella in North America. Rhodora **40:** 20. 1938.

blades as described for var. *latifolia* (Gray's Manual. 1523. 1950). *No. 9725* has divergent elongated branches.

*Aster linariifolius L. is represented in our herbarium by *Waterfall 9866*, in pine-oak woods, 10 miles north of Broken Bow, McCurtain County, October 22, 1950. Small (Manual. 1395. 1933) gave the range of this species (under *Ionactes*) as Florida to Texas, Minnesota and Michigan.

*Baccharis halamifolia L. Fernald (Gray's Manual. 1448, 1950) says this species occurs in open woods, thickets and borders of marshes near the coast, Florida to Texas and Mexico, north to coast of Massachusetts. We have it as *Waterfall 9827*, old field 4 miles south of Idabel, McCurtain County, October 21, 1950.

*Coreopsis tripteris L., var. deamii Standl. This variety, having leaves pubescent beneath, was collected as *Waterfall 10166*, open woods on stony slopes 1 mile east and 3 south of Kansas, Delaware County, July 11, 1951. Standley[11] in describing this variety cited specimens from Illinois, Indiana, Michigan, Missouri, Arkansas, Pennsylvania, North Carolina and Georgia.

*Echinacea purpurea (L.) Moench, var. arkansana Steyermark. *Burris 65*, sandy clay, 4 miles west of Idabel, McCurtain County is so referred. It has the smaller leaves, heads, rays, paleas and slender stem as described by Steyermark[12] from Sevier County, Arkansas.

*Erechtites hieracifolia (L) Raf., var. intermedia Fern. This variety, with broad-based sessile leaves which are reduced below the inflorescence, was collected as *Waterfall 9865*, slopes of mountain, hairpin curve, 12 miles southeast of Bethel, McCurtain County, October 22, 1950. Fernald (Gray's Manual. 1528. 1950) says it occurs from P. E. I. to west Ontario, south to Florida and Texas.

*Erechtites hieracifolia (L.) Raf., var. praealta (Raf.) Fern. The variety with upper leaves attenuate at the base was collected as *Waterfall 9781*, edges of Taxodium swamps, 3 miles south of Eagletown, McCurtain County, October 21, 1950. In Gray's Manual (l. c.) the range is given as Quebec to Wisconsin, south to Florida and Tennessee.

*Eupatorium capillifolium (Lam.) Small. This species, having finely-divided leaves, was collected as *Waterfall 10499*, old field, 0.5 miles north of Tom, McCurtain County, October 14, 1951. In Gray's Manual (1365. 1950) the western part of the range is stated to be ". . . to Texas, north to New Jersey."

*Euthamia leptocephala (T. & G.) Greene. So referred is *Waterfall 10489*, old field, 0.5 miles north of Tom, McCurtain County, October 14, 1951. Shinners[13] states that this is the common *Euthamia* of eastern

[11] Standley, Paul C. New Forms and Varieties of Indiana Plants. Rhodora **32**: 33–34. 1930.

[12] Steyermark, Julian A. Two Undescribed Plants from Arkansas. Rhodora **40**: 71. 1938.

[13] Shinners, Lloyd H. The Texas Species of Euthamia. Field and Lab. **19**: 137–138. 1951.

Texas. Fernald (Gray's Manual: 1412. 1950) includes "east Texas . . . and south Missouri" in the range of this species.

*Helianthus hirsutus Raf., var. trachyphyllus T. & G. This variety, without long-hirsute internodes and with broad leaves, is represented by *Waterfall 10270*, oak-hickory woods, 4 miles southeast of Braggs, Muskogee County, July 19, 1951. Fernald (Gray's Manual: 1492. 1950) gives the range as west Pennsylvania to Wisconsin and Iowa, south to Tennessee and Arkansas.

*Hieracium gronovii L., var. foliosum Michx. is said to have "numerous cauline leaves extending nearly or quite into the inflorescence, . . . oval and rounded at the summit . . ." (Rhodora **37:** 185. 1935). Such material was collected as *Waterfall 10427*, pine-oak woods, 2 miles north of Tom, McCurtain County, October 13, 1951. Fernald (l. c.) says "it is dominant on the coastal plain, extending . . . northward in the interior to southern Indiana and Missouri."

*Solidago rugosa Mill., var. aspera (Ait.) Fern. So referred is material collected as *Waterfall 9821*, edges of Taxodium swamp, 3 miles south of Eagletown, McCurtain County, October 21, 1950. The leaves are rugose, but the branches are not elongated and divergent as in var. *celtidifolia*, and they produce flowers throughout most of their length. Fernald (Rhodora **38:** 222. 1936) includes Texas and Missouri in the western part of the range of this variety.

*Solidago rugosa Mill., var. celtidifolia (Small) Fern. So referred is *Hopkins 5602*, deep, rich pine-oak-gum-hickory woods on slope of Rich Mountain, Ouachita Mountains, near Page, LeFlore County, October 13, 1940.

This specimen has the prolonged divergent branches, floriferous above the middle as Fernald describes var. *celtidifolia*.[14] This variety has been recorded previously from as far west as the neighboring states of Texas and Arkansas by both Small (Flora . . . 1198. 1903) and Fernald (l. c.).—Department of Botany and Plant Pathology, Oklahoma A. & M. College, Stillwater, Oklahoma.

COLOR-FORMS OF THE MAY-APPLE

Julian A. Steyermark

In 1948 Dr. Marcel Raymond of the Montreal Botanical Garden described (Rhodora **50:** 18) *Podophyllum peltatum* f. *Deamii*, based upon a plant with maroon or dark-reddish fruit found originally by Dr. C. C. Deam in 1927 in "a wood on the Arthur Miller farm near Mauckport, Harrison County," Indiana. From the living plants grown by Deam in his garden and sent to the Montreal Botanical Garden, the latter institution succeeded

[14] Fernald, M. L. Rhodora 38: 223–224. 1936.

in growing plants to maturity and eventually offered seeds for distribution to a number of other botanical gardens. So far as known, this color form existed in a wild state only in Indiana, although it was expected to be found eventually in a wild state throughout the range of ordinary *P. peltatum*.

About the time Dr. Raymond's form was published, Mrs. Mary C. Rodeman of Jefferson City, Missouri, wrote the present author that she had found a pink-flowered purplish-red-fruited form of the May-apple near Jefferson City, eventually kindly furnishing me with an herbarium specimen and a kodachrome slide as evidence. She had been acquainted with this color variation since 1923. In the spring of 1950 she had taken a couple of the plants to Dr. Edgar Anderson for planting at the Missouri Botanical Garden Arboretum.

Since I was curious to learn whether Mrs. Rodeman's plant was actually the same form as that found by Deam, I undertook a special trip to the Missouri locality in July, 1950. Mrs. Rodeman kindly offered to accompany me, despite the rain, to the exact spot where she knew the plants to grow. Mr. Albert Vatter, Jr., a graduate student at the University of Illinois, was the third member of the party. Mrs. Rodeman led us to a spot of undisturbed woodland on the slopes of a shallow ravine bordering a small creek tributary to the Moreau River south of the golf course of Hough Park and about three-quarters of a mile southwest of the city limits of Jefferson City, the state capitol. The woods were dominated by *Quercus alba*, *Carya tomentosa*, and *C. ovata*, with an understory of *Cornus florida* and *Sassafras albidum*. Acid-soil plants, such as *Ranunculus Harveyi*, were associated with the May-apple.

It was not long before we located several plants showing the maroon-colored fruits. Altogether nearly two-dozen plants of this form were seen in two separate colonies mixed with the ordinary yellow-fruited kind. A splendid opportunity was afforded here for noting the color differences in the field. We observed other characteristics besides the maroon-colored pericarp: the fleshy portion of the fruit was a sordid white suffused with a pinkish-lavender tinge, the seeds were maroon or dark vinaceous, somewhat similar in color to some apple seeds, the fruiting peduncle purplish, the tip of the rhizome reddish-purple, and the

stems suffused with dull lavender. In contrast to this, the ordinary May-apple had a yellow-green or pale yellow pericarp, a white fleshy portion, yellow seeds, tip of the rhizome yellowish, and the stems and peduncle more predominantly yellowish-green.

Again in May of the following year the same locality was revisited in order to check on the nature of the flowering plants. Here the contrast was quite marked, as the petals of the maroon-fruited form were a delicate shade of pink or suffused with pinkish. Moreover, the stigma and ovary were of a deep or dark vinaceous color, whereas the short anthers were yellow and the filaments pale yellow. The peduncle, pedicel, and petiole were flecked throughout with lavender and the tip of the rhizome bud was a deep vinaceous color, as it had been in the fruiting specimen.

Herbarium material was collected on both trips from flowering and fruiting plants and is preserved in the Gray Herbarium, and the herbaria of the Missouri Botanical Garden and Chicago Natural History Museum. Living material from these collections was brought back to the author's wild flower preserve in northeastern Illinois. The plants are thriving, as are also those kindly sent to the author by Dr. Deam from his original colony. A careful examination of the Missouri plants leaves no doubt that they are the same as the Indiana forma *Deamii*, and comprise the second wild record within the natural range of the form.

The collection data for the Missouri specimens are as follows: *Steyermark 69987*, wooded (oak-hickory-flowering dogwood) slopes above small tributary at south end of Hough Park, a few hundred yards southwest of golf course hole no. 12, ½ mile south of limits of Jefferson City, T 44 N, R 11 W, west-central part of sect. 19, Cole Co., July 17, 1950, "about 20 plants seen in two colonies"; *Steyermark 71155*, same locality, May 6, 1951.

Although forma *Deamii* has as yet not been found in a wild state in Illinois, another variant in fruit color from Illinois was recently discovered by Mrs. Valerie Bordener, who called Mrs. Julian Steyermark's attention to an orange-colored form which she had found in a natural stand of woodland only a short distance from the author's home in the Biltmore Estates subdivision, north of Barrington, Lake County. She and the author's wife, Mrs. Cora Steyermark, collected fruiting specimens in 1950

from a colony of a dozen plants. The pericarp was of a rich apricot or mango orange color with yellowish-white flesh within. The seeds, however, unlike those of forma *Deamii*, are yellow as in ordinary *P. peltatum*. The peduncle is suffused with pale apricot orange. The rhizome and upper portion of the stem are yellowish-green, while the lower part of the stem is a pale brick color.

The following spring in 1951 I made observations of flowering material, but could detect no differences between the orange-fruited form and the ordinary kind with which it was growing. The plants were again checked in fruit during August, 1951 and the same plants showed the orange color of the pericarp as contrasted with the usual pale yellow color of surrounding specimens. All these plants grew in an upland forest dominated by *Quercus alba*, *Q. ellipsoidalis*, and *Carya ovata* on the upper slopes of a ravine bordering a small creek. In the same area occurs a natural stand of over two hundred plants of *Liparis lilifolia*. A couple of transplanted specimens of this may-apple are thriving in the author's wild flower preserve, and seedlings grown from the seed of this form are now in their second year and will be watched for future performance.

To commemorate the name of the general locality where the plants were discovered, this form may be known as,

Podophyllum peltatum, f. **biltmoreanum** Steyermark, f. nov., a typo differt pericarpio aurantiaco et carne luteo-albido.—North-facing open oak-hickory wooded slope on northeast side of creek, south of Eton Drive and west of Kimberley Road, on the property of George Foster, just southwest of Bordener's house, Biltmore Estates subdivision, 5 miles north of Barrington, Lake Co., Illinois, August 16, 1950, *Mrs. Valerie Bordener and Mrs. Cora Steyermark*, type, in Herb. Chi. Nat. Hist. Mus.—Chicago Natural History Museum and Missouri Botanical Garden.

STATUS OF PHRAGMITES COMMUNIS TRIN., VAR. BERLANDIÈRI (FOURN.) FERNALD ALONG THE SUDBURY RIVER IN EASTERN MASSACHUSETTS

Richard J. Eaton

This paper is contributed as an additional note on recent changes in the aquatic vegetation of the Sudbury River, primarily in the towns of Wayland, Sudbury and Concord, Massachusetts. Several years ago I published an article on this subject (Eaton, 1947) with particular reference to the weedy behavior of *Lemna minor* L., and *Trapa natans* L., and to the fading out of *Nymphaea odorata* Ait. The two former species prefer subneutral to slightly alkaline waters, whereas the latter thrives chiefly in neutral to slightly acid water overlying rich organic mud. These changes were correlated with marked concurrent increases in river pollution by alkaline sewage waters, a suggestion which has been generally accepted as a likely explanation of the observed phenomena.

Recent observations of the behavior of *Phragmites communis* Trin. var. *Berlandièri* (Fourn.) Fern. in the grassy meadows bordering the Sudbury River near Wayland add one more bit of information to the subject.

The North American variety of *P. communis* is considered an uncommon species in New England where it occurs chiefly near the coast on borders of brackish marshes, or on pond margins, etc., associated with underlying glacial clays. It appears to be very scarce inland in eastern Massachusetts, being cited as occurring inland only at Andover and S. Lincoln without reference to specimens (Boston District, 1913). Presumably the S. Lincoln station is on the Sudbury River meadows which border that town on the west. Until this year I have considered it a rare plant in the Sudbury River Valley. The Herbarium of the New England Botanical Club contains only one specimen from this area, collected in Wayland, July 31, 1859, by H. D. Thoreau. Although I have been familiar with these river meadows at all seasons of the year for about fifty years I never encountered *Phragmites* in the region until the winter of 1949–50, when I found a few scattered fruiting culms sticking up through the meadow ice on

the west side of the river channel not far below the lower Wayland-Sudbury bridge. At that time I made an extensive survey on skates of a very large acreage of the meadows in order to ascertain the local distribution of the plant. Conditions were favorable for such a search, as the grass had not been cut for several years and the flooded meadows had frozen over for the first time a fortnight or so previously. No appreciable movement of the ice had occurred to shear off the embedded grasses. I found two small areas where scattered fruiting culms were exposed above the ice, both of them in the upper (Wayland) end of the meadows on the west side of the river channel.

This year on January 22, 1952, I made another survey on skates of the meadows on the west side of the river from the Concord line up to the Wayland bridge, a distance of about seven miles. No *Phragmites* was found below the areas noted in 1949–50, but fruiting culms were far more abundant in more extensive and numerous (four) patches. I returned two weeks later for specimens. The two additional colonies found this year were by far the most conspicuous. One of them, near the Wayland golf course on the east side of the channel, consisted of a narrow dense strip about thirty meters long; the other, across the meadows a third of a mile to the northwest, was a luxuriant growth about seventy-five meters long by twenty-five meters wide, and clearly visible through binoculars at a distance of a half mile. I am confident that these two patches did not fruit in 1949; otherwise I would not have overlooked them the following winter.

As judged by the winter occurrence of fruiting culms in this locality I think that *Phragmites* has prospered exceedingly well during the past few years and in all probability has increased strikingly in abundance and in vigor as well. During the past fifty years or more the Sudbury River meadows have been frequently explored by competent botanists. It is difficult to believe that it would have been overlooked by such men as M. L. Fernald, Emile Williams, A. W. Hosmer (of Concord) and many others, if formerly it had been as conspicuous and plentiful as now. (One large patch grows in the open meadow within fifty meters of the Wayland-Sudbury road.) Therefore, I hazard the guess that it has persisted sparsely in the area for a very long

time in a depauperate and vegetative state, rarely fruiting until very recently.

Assuming that the status of this grass has in fact changed, it is reasonable to infer that it has done so in response to changed nutritional factors arising from increased sewage pollution. Fassett states that *Phragmites communis* in North America occurs mostly in brackish places (Fassett, 1940); Svenson characterizes it as an "indifferent halophyte" (Svenson, 1927); Fernald refers to it as commonly maritime (Fernald, 1910). Obviously, the acid soils and peats of central Middlesex County are not favorable to its proper development, whereas the annual flood waters of a heavily polluted stream, frequently stagnating on the meadows until well into May, are likely to furnish the alkalinity required for normal luxuriance.

In this connection, I am reminded of finding true *Potamogeton pusillus* L. (= *P. panormitanus* Biv.) in the Sudbury River near Wayland in the summer of 1933. Quoting from a note in Rhodora on the subject: "According to Fernald it shows a very striking preference for basic or slightly alkaline (or brackish) waters. Consequently it seems somewhat out of place in a sluggish river noted for its peaty meadows." (Eaton and Griscom, 1934.) In the light of my later *Lemna* article, the occurrence of this pond weed in the polluted river, infrequently if ever to be found in neutral to acid waters, seems less strange than when first collected. Even in 1933 the river was strongly polluted by sewage, as shown by chemical analysis (See Table of Water Analyses in Eaton, 1947). The increasing abundance of *Wolffia columbiana* Karst, another plant chiefly of alkaline waters, twelve miles farther downstream in Concord is also suggestive of vegetational changes in the river. It was first collected there in 1938, an eastward range extension from the general line, Lake Champlain-Connecticut River-western Connecticut (Eaton, 1939).

Lincoln, Mass.

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The Type of Ulmus americana L.—The type of *Ulmus americana* L. has been a problem ever since the days of Asa Gray. So long as only one form of the white or American elm was recognized, the problem could be allowed to rest without disturbing taxonomists.

Now however since at least four different forms are recognized, a solution is more urgent. It becomes more important to ascertain which is the type and what are the distinctive characters of the type.

Dr. M. L. Fernald in proposing four forms stated: "so far as I can find, the actual type of Linnaeus has not been closely examined to determine to which of the four variations it belongs."[1] The photograph of the type which he had before him, he added, was "wholly inconclusive." (l.c.)

As war-time conditions doubtless made it impracticable to follow the matter further just then in order to solve the problem, the uncertainty continued through the publication of the eighth edition of Gray's Manual, which again described four forms without indicating which was typical.

Recently some correspondence with English botanists has thrown light on the question. I wish here to acknowledge with great appreciation the help of Mr. S. Savage, Assistant Secretary of the Linnaean Society of London, and especially of Dr. R. Melville, of the Royal Botanic Gardens, Kew. The latter has sent me conclusive information.

The first question is to determine with certainty what specimen is the type. In order to set forth the facts fully and avoid subsequent doubt on some points, three sheets in the Linnaean Herbarium may well be cited:

1. Sheet No. 321.1 needs to be mentioned only to eliminate it from consideration, as it is *Ulmus campestris* L. or, as that is regarded as a nomen ambiguum, it is better known as *Ulmus glabra* Huds. It has no bearing on the type of *Ulmus americana* L.

[1] Rhodora **47**: 132 (1945).

2. Sheet No. 321.2 is marked "2 americana" by Linnaeus. However, Asa Gray annotated it: "est Ulm. fulva Michx. A. G." Dr. Melville confirms the latter determination. *Ulmus fulva* Michx. is now regarded as a synonym of *Ulmus rubra* Muhl.

3. Sheet No. 321.3 has only "Ulmus" on the front in the handwriting of Linnaeus, but on the back he has written: "Ulmus altitudinis et crassitiei minori foliis latioribus rugosis Clayt. (n. 524)." Dr. Melville writes: "The reference in the Species Plantarum to Gronovius, Flora Virginica ties up with sheet 321.3 and the words on the back of the sheet referring to Clayton's no. 524 are repeated on p. 39 of the Flora Virginica, edition of 1762." If it were not for this annotation, there might be doubt as to whether this sheet or no. 321.2 should be chosen as the type.

Dr. Melville points out that "Linneus' conception of an elm species was very broad, for he included all the rough-leaved and smooth-leaved elms of Europe known to him in his *U. campestris* (Journ. Bot. **76:** 261, 1938). There is nothing incongruous therefore in the inclusion by Linneus of both the slippery elm and the American white elm under *U. americana.* The annotation on the back of the sheet and the reference to the Flora Virginica in the Species Plantarum leave no room for doubt that Linneus intended to include sheet no. 321.3 in *U. americana.* A choice must now be made between the two elements united by Linneus for the strict application of the name under the Rules of Botanical nomenclature. Fortunately it is possible to continue the long established usage of the name by selecting as the type of *U. americana* L. sheet no. 321.3. of the Linnean herbarium."

The second question is to ascertain which of the forms is the typical. Dr. Melville describes the type (no. 321.3) as follows: It is " 'Ulmus americana L.' as generally understood. It consists of a branch with fruits and young leaves. The leaves are glabrous above and are sparingly pubescent below, but this indumentum appears to be falling off and the leaves would be substantially glabrous on both sides at maturity. The young branchlets are glabrous. This sheet clearly represents *U. americana* L. f. *laevior* Fernald."

This information enables us to understand that typical *Ulmus americana* L. is the form with glabrous branchlets, and smooth (not scabrous) leaves, which Dr. Fernald (pending determination of the type) described as f. *laevior.* Forma *laevior* Fernald is therefore a synonym for typical *Ulmus americana* L.—Frank C. Seymour. Tomahawk, Wisconsin.

A Color-form of Beech-drops.—The form of *Epifagus virginiana* (L.) Bart. in which the whole plant instead of its usual brown-madder shade is pale straw-colored to yellowish has been described by C. A. Weatherby as f. *pallida*, and is occasional in the White Mountain region, e. g., in Randolph and Gorham, N. H. For another even more striking color-variant, however, in which the whole plant (except the corolla) has a black-purple hue, there seems to be as yet no designation, and for convenience of reference it may be characterized as

Epifagus virginiana (L.) Bart., f. **atropurpurea** n. f., caulibus et squamis calycibusque atropurpureis.—Maine, Bickford Trail, Stow, 30 Aug., 1951 (*Pease*); New Hampshire, Randolph, 8 Sept., 1920 (*Pease 18087*, type) in N. E. B. C.

With these color-forms of *Epifagus* may be compared several in *Corallorhiza*, discussed by H. H. Bartlett in Rhodora, 24 (1922), 145–148, and by M. L. Fernald in Rhodora, 48 (1946), 197.—Arthur Stanley Pease, Randolph, N. H.

Stages in the Evolution of Plant Species[1]:—In a series of essays first presented as lectures under the Messenger Foundation at Cornell University, Clausen has brought together material and points of view largely derived from his own work on *Viola* and that of his research group at the Carnegie Institution of Washington on a number of plants, particularly of the Compositae. A fair proportion of the material covered in the book has appeared in print elsewhere, but there are a number of new illustrations, maps, charts, and diagrams. Furthermore, the subject matter has been considered in a logical sequence and from several points of view, although cytogenetics and experimental taxonomy have dominated the author's thinking. The following chapter headings give an idea of the book's contents: the evolution of our concepts of speciation; the local population as the basic evolutionary unit; the evolution of ecological races; the genetic systems of ecological races and morphological subspecies; the evolution of interspecific barriers; the evolution of groups of species; the physiologic-genetic species concept and the dynamics of the evolution of species and genera. The last chapter is significant because it represents an attempt to shift some of the emphasis from the negative aspects of the species problem to the positive. This is a trend that is long overdue and it is to be hoped that further information will be forthcoming from the laboratory of Dr. Clausen. On the whole, scientists interested in the genetic phases of speciation have in recent years been overly occupied with studies concerning barriers between species rather than with the nature of the species themselves.—R. C. Rollins.

[1] *Stages in the Evolution of Plant Species.* By Jens Clausen. viii + 206. Cornell University Press, Ithaca, 1951. $3.50.

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